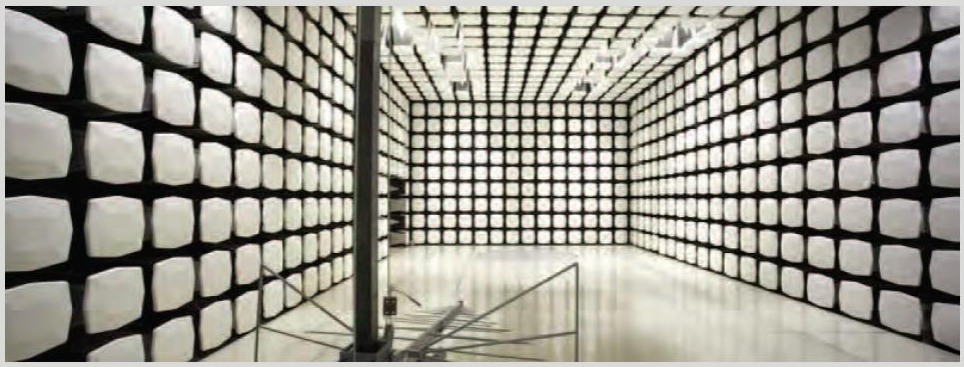
Sensoteq Ltd

Vibration Monitoring System

FCC 15.231:2017

Periodic Transmitter

Report # ELEM0040.1



NVLAP Lab Code: 200676-0

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CERTIFICATE OF TEST

2017-1-25

Last Date of Test: September 6, 2017
Sensoteq Ltd
Model: Vibration Monitoring System

Radio Equipment Testing

Standards

Specification	Method
FCC 15.231:2017	ANSI C63.10:2013

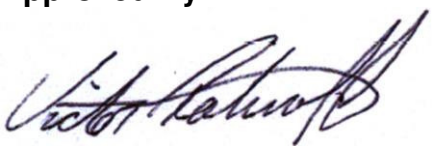
Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required for a battery powered EUT.
6.5, 6.6	Field Strength of Fundamental	Yes	Pass	
6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	
6.9.2	Occupied Bandwidth	Yes	Pass	
7.5	Duty Cycle	Yes	Pass	

Deviations From Test Standards

None

Approved By:



Victor Ratinoff, Operations Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information.

REVISION HISTORY

Revision Number	Description	Date	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

2017.6.12

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Element to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with ISED.

European Union

European Commission – Within Element, we have a EU Notified Body validated for the EMCD and RED Directives.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIP / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

SCOPE

For details on the Scopes of our Accreditations, please visit:
http://portlandcustomer.element.com/ts/scope/scope.htm
http://gsi.nist.gov/global/docs/cabs/designations.html

MEASUREMENT UNCERTAINTY

TMU.2015.07.10

Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

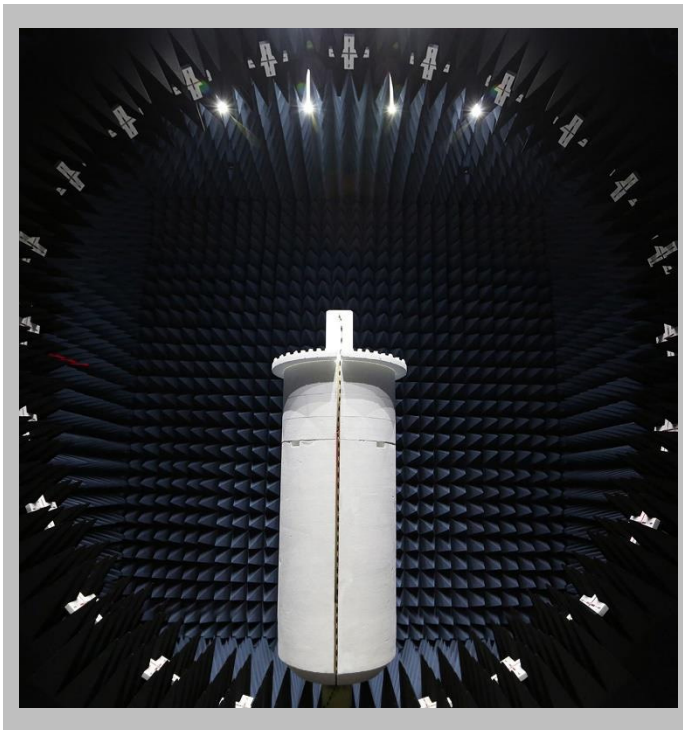
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

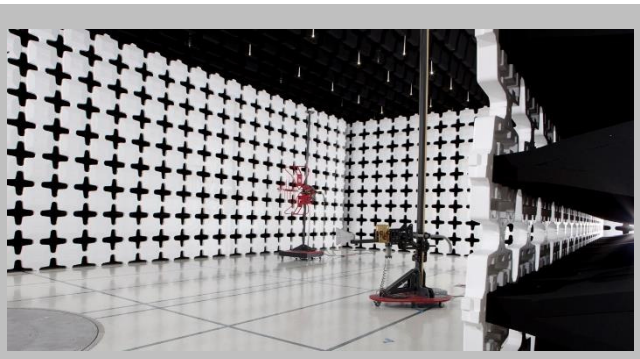
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

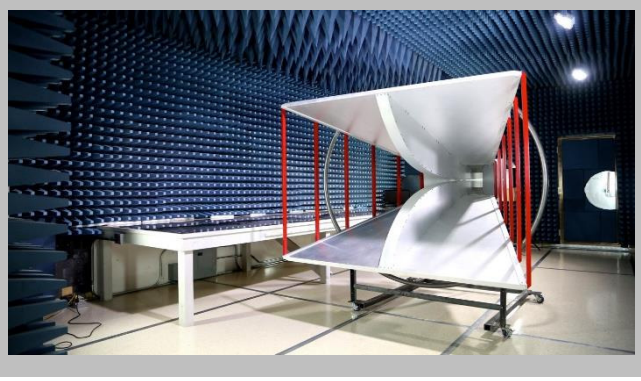
FACILITIES

2017.7.25

California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada					
2834B-1, 2834B-3	2834E-1, 2834E-3	N/A	2834D-1, 2834D-*2*	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157

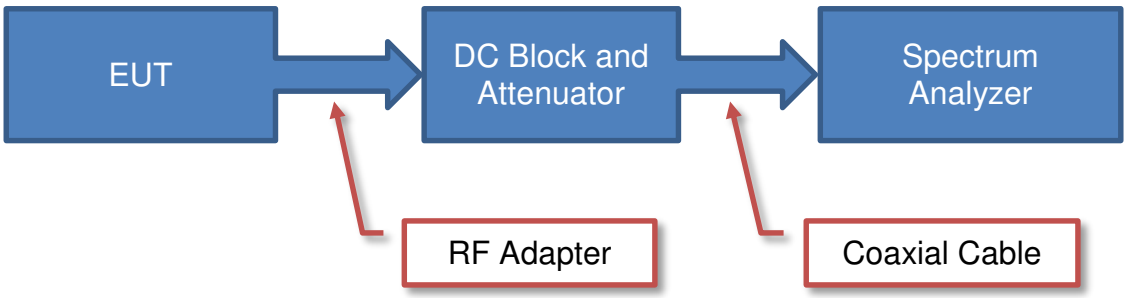




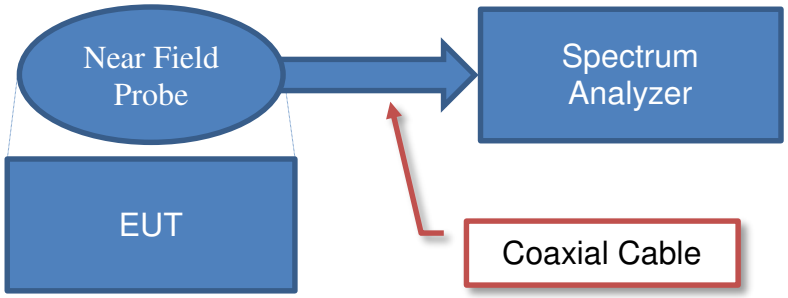


Test Setup Block Diagrams

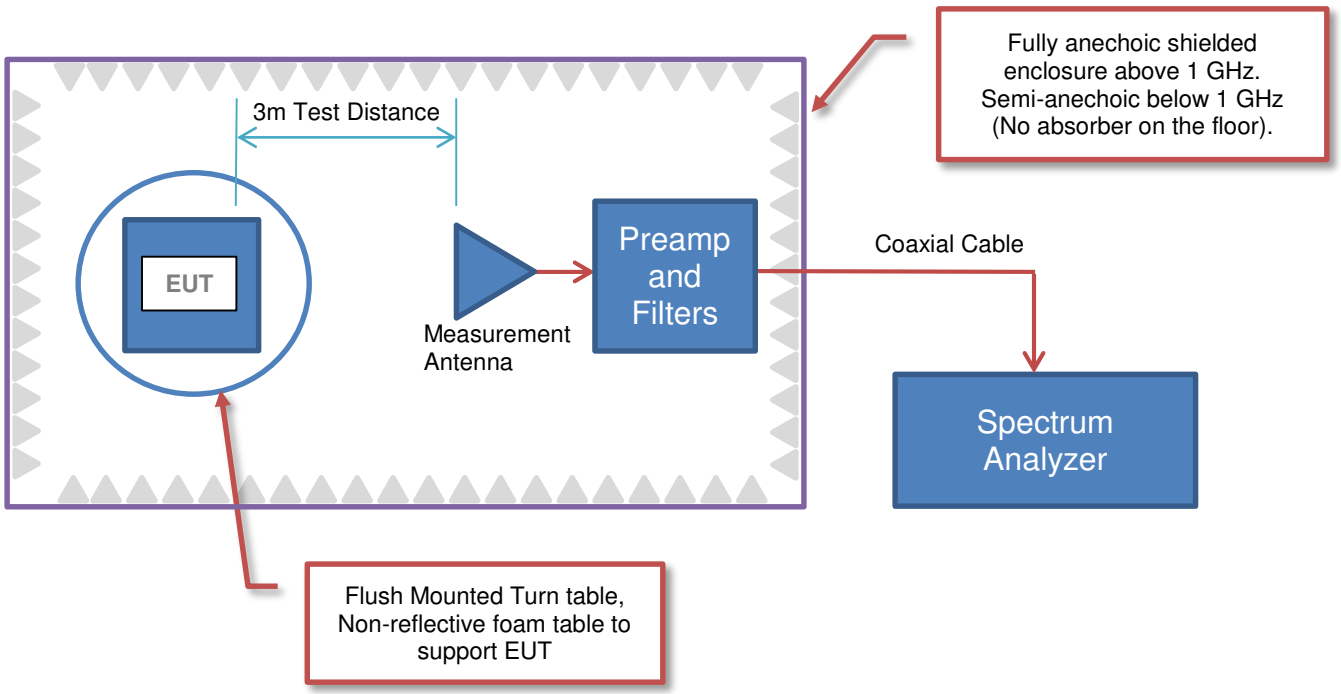
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Sensoteq Ltd
Address:	Unit 18 Ormeau Business Park
City, State, Zip:	8 Cromac Avenue, Belfast BT7 2JZ Northern Ireland
Test Requested By:	Alex Toohie of Element Materials Technology Warwick Ltd.
Model:	Vibration Monitoring System
First Date of Test:	September 6, 2017
Last Date of Test:	September 6, 2017
Receipt Date of Samples:	September 6, 2017
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Vibration Monitoring System containing a low power transmitter which operates at 433 MHz utilizing GFSK modulation.

Testing Objective:
To demonstrate compliance of the periodic radio to FCC 15.231(e) requirements.

CONFIGURATIONS

2017-1-25

Configuration ELEM0040- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Vibration Monitoring System (10 sec)	Sensoteq Ltd	ANTS1001	16BE04

Configuration ELEM0040- 2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Vibration Monitoring System (100%)	Sensoteq Ltd	ANTS1001	16BE03

MODIFICATIONS

2017-1-25

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	9/6/2017	Field Strength of Fundamental	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	9/6/2017	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	9/6/2017	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	9/6/2017	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

FIELD STRENGTH OF FUNDAMENTAL

PSA-ESCI 2017.06.01

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Continuously Transmitting at 433 MHz

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

ELEM0040 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency	432 MHz	Stop Frequency	434 MHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Cable	Element	10kHz-1GHz RE Cables	OCH	8/1/2017	12 mo
Antenna - Biconilog	EMCO	3142	AXB	11/6/2015	24 mo
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFJ	1/28/2017	12 mo

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was configured for continuous modulated operation at its single transmit frequency. The field strength of the transmit frequency was maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT in 2 orthogonal planes (per ANSI C63.10:2013).

To derive average emission measurements, a duty cycle correction factor was utilized:

Duty Cycle = On time/100 milliseconds (or the period, whichever is less)

Where “On time” = N1L1 +N2L2 +….

Where N1 is the number of type 1 pulses, L1 is length of type 1 pulses, N2 is the number of type 2 pulses, L2 is the length of type 2 pulses, etc.

Therefore, Duty Cycle = (N1L1 +N2L2 +…)/100mS or T, whichever is less. (Where T is the period of the pulse train.)

The measured values for the EUT’s pulse train are as follows:

Period = 98.43 mSec
Pulsewidth of Type 1 Pulse = 17.73 mSec
Number of Type 1 Pulses = 1

Duty Cycle = 20 log [((1)(17.73))/98.43] = -14.89 dB

The duty cycle correction factor of –14.89 dB was added to the peak readings to mathematically derive the average levels. Peak measurements were made with a resolution bandwidth of 100kHz and a video bandwidth of 300kHz.

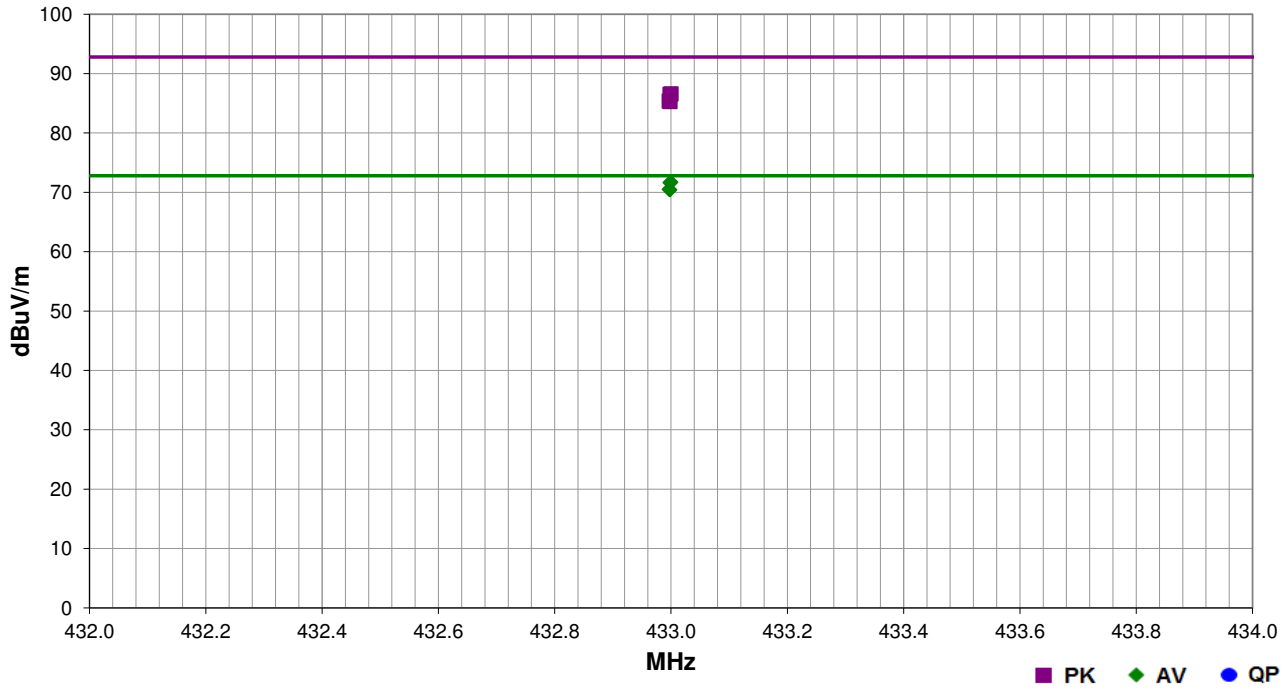
FIELD STRENGTH OF FUNDAMENTAL

EmiR5 2017.07.11 PSA-ESCI 2017.06.01

Work Order:	ELEM0040	**Date:**	09/06/17		
Project:	None	**Temperature:**	22.9 °C		
Job Site:	OC10	**Humidity:**	45.2% RH		
Serial Number:	16BE03	**Barometric Pres.:**	1017 mbar	**Tested by:**	Johnny Candelas
EUT:	Vibration Monitoring System				
Configuration:	2				
Customer:	Sensoteq Ltd				
Attendees:	Idir Boudaoud				
EUT Power:	Battery				
Operating Mode:	Continuously Transmitting at 433 MHz				
Deviations:	None				
Comments:	Power Setting -6, using -14.89dB DCCF				

Test Specifications	**Test Method**
FCC 15.231:2017	ANSI C63.10:2013

Run #	3	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
433.000	63.2	23.4	1.3	180.0	-14.9	0.0	Vert	AV	0.0	71.7	72.8	-1.1	EUT Horiz
432.998	63.1	23.4	1.3	351.0	-14.9	0.0	Vert	AV	0.0	71.6	72.8	-1.2	EUT Vert
432.997	62.0	23.4	1.0	271.0	-14.9	0.0	Horz	AV	0.0	70.5	72.8	-2.3	EUT Horiz
432.998	61.9	23.4	2.1	37.0	-14.9	0.0	Horz	AV	0.0	70.4	72.8	-2.4	EUT Vert
433.000	63.2	23.4	1.3	180.0		0.0	Vert	PK	0.0	86.6	92.8	-6.2	EUT Horiz
432.998	63.1	23.4	1.3	351.0		0.0	Vert	PK	0.0	86.5	92.8	-6.3	EUT Vert
432.997	62.0	23.4	1.0	271.0		0.0	Horz	PK	0.0	85.4	92.8	-7.4	EUT Vert
432.998	61.9	23.4	2.1	37.0		0.0	Horz	PK	0.0	85.3	92.8	-7.5	EUT Horiz

SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2017.06.01

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Continuously Transmitting at 433 MHz

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

ELEM0040 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	5000 MHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Amplifier - Pre-Amplifier	Miteq	AMF-4D-010120-30-10P-1	AOP	7/13/2017	12 mo
Cable	Element	1-8GHz RE Cables	OCJ	7/13/2017	12 mo
Antenna - Double Ridge	EMCO	3115	AHB	3/21/2016	24 mo
Attenuator	Fairview Microwave	SA18H-10	TKP	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AM-1402	AOZ	8/1/2017	12 mo
Cable	Element	10kHz-1GHz RE Cables	OCH	8/1/2017	12 mo
Antenna - Biconilog	EMCO	3142	AXB	11/6/2015	24 mo
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFJ	1/28/2017	12 mo

TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequency in each operational band and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

To derive average emission measurements, a duty cycle correction factor was utilized:

Duty Cycle = On time/100 milliseconds (or the period, whichever is less)

Where “On time” = N1L1 +N2L2 +….

Where N1 is the number of type 1 pulses, L1 is length of type 1 pulses, N2 is the number of type 2 pulses, L2 is the length of type 2 pulses, etc.

Therefore, Duty Cycle = (N1L1 +N2L2 +…)/100mS or T, whichever is less. Where T is the period of the pulse train.

The measured values for the EUT’s pulse train are as follows:

Period = 98.43 mSec
Pulsewidth of Type 1 Pulse = 17.73 mSec
Number of Type 1 Pulses = 1

Duty Cycle = 20 log [((1)(17.73))/98.43] = -14.89 dB

The duty cycle correction factor of –14.89 dB was added to the peak readings to mathematically derive the average levels. Peak measurements were made with a resolution bandwidth of 100kHz and a video bandwidth of 300kHz for measurements at or below 1GHz. Above 1GHz, a resolution bandwidth of 1MHz and a video bandwidth of 3MHz was used.

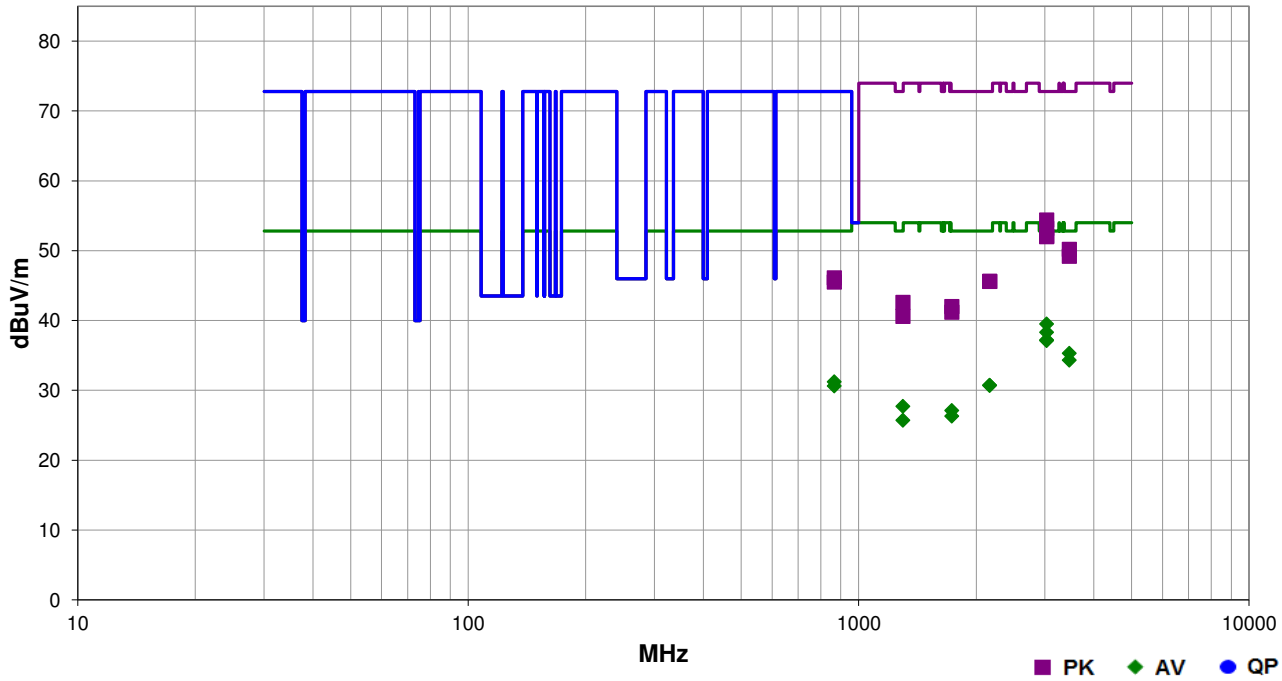
SPURIOUS RADIATED EMISSIONS

EmiR5 2017.07.11 PSA-ESCI 2017.06.01

Work Order:	ELEM0040	**Date:**	09/06/17		
Project:	None	**Temperature:**	23.8 °C		
Job Site:	OC10	**Humidity:**	48.4% RH		
Serial Number:	16BE03	**Barometric Pres.:**	1017 mbar	**Tested by:**	Johnny Candelas
EUT:	Vibration Monitoring System				
Configuration:	2				
Customer:	Sensoteq Ltd				
Attendees:	None				
EUT Power:	Battery				
Operating Mode:	Continuously Transmitting at 433 MHz				
Deviations:	None				
Comments:	Power Setting -6, using -14.89dB DCCF				

Test Specifications	**Test Method**
FCC 15.231:2017	ANSI C63.10:2013

Run #	4	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
3031.015	48.5	5.9	1.9	258.0	-14.9	0.0	Horz	AV	0.0	39.5	52.8	-13.3	EUT Vert
3031.005	47.3	5.9	1.5	307.0	-14.9	0.0	Vert	AV	0.0	38.3	52.8	-14.5	EUT Horiz
3030.945	46.2	5.9	2.0	158.0	-14.9	0.0	Horz	AV	0.0	37.2	52.8	-15.6	EUT Horiz
3030.825	46.1	5.9	1.3	140.0	-14.9	0.0	Vert	AV	0.0	37.1	52.8	-15.7	EUT Vert
3463.940	43.0	7.2	2.2	294.0	-14.9	0.0	Vert	AV	0.0	35.3	52.8	-17.5	EUT Horiz
3031.015	48.5	5.9	1.9	258.0		0.0	Horz	PK	0.0	54.4	72.8	-18.4	EUT Vert
3463.960	42.0	7.2	1.6	300.0	-14.9	0.0	Horz	AV	0.0	34.3	52.8	-18.5	EUT Vert
3031.005	47.3	5.9	1.5	307.0		0.0	Vert	PK	0.0	53.2	72.8	-19.6	EUT Horiz
3030.945	46.2	5.9	2.0	158.0		0.0	Horz	PK	0.0	52.1	72.8	-20.7	EUT Horiz
3030.825	46.1	5.9	1.3	140.0		0.0	Vert	PK	0.0	52.0	72.8	-20.8	EUT Vert
865.637	20.9	15.2	1.0	92.0	-14.9	10.0	Horz	AV	0.0	31.2	52.8	-21.6	EUT Vert

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2164.980	43.1	2.5	2.5	307.0	-14.9	0.0	Horz	AV	0.0	30.7	52.8	-22.1	EUT Vert
2164.955	43.1	2.5	1.0	168.0	-14.9	0.0	Vert	AV	0.0	30.7	52.8	-22.1	EUT Horiz
866.057	20.4	15.1	1.0	347.0	-14.9	10.0	Vert	AV	0.0	30.6	52.8	-22.2	EUT Horiz
3463.940	43.0	7.2	2.2	294.0		0.0	Vert	PK	0.0	50.2	72.8	-22.6	EUT Horiz
3463.960	42.0	7.2	1.6	300.0		0.0	Horz	PK	0.0	49.2	72.8	-23.6	EUT Vert
1299.060	44.3	-1.7	1.0	305.0	-14.9	0.0	Vert	AV	0.0	27.7	52.8	-25.1	EUT Horiz
1732.000	41.3	0.7	1.3	326.0	-14.9	0.0	Vert	AV	0.0	27.1	52.8	-25.7	EUT Horiz
1731.855	40.5	0.7	1.0	289.0	-14.9	0.0	Horz	AV	0.0	26.3	52.8	-26.5	EUT Vert
866.273	20.9	15.2	1.0	92.0		10.0	Horz	PK	0.0	46.1	72.8	-26.7	EUT Vert
1299.000	42.3	-1.7	1.4	269.0	-14.9	0.0	Horz	AV	0.0	25.7	52.8	-27.1	EUT Vert
2164.980	43.1	2.5	2.5	307.0		0.0	Horz	PK	0.0	45.6	72.8	-27.2	EUT Vert
2164.955	43.1	2.5	1.0	168.0		0.0	Vert	PK	0.0	45.6	72.8	-27.2	EUT Horiz
865.962	20.4	15.1	1.0	347.0		10.0	Vert	PK	0.0	45.5	72.8	-27.3	EUT Horiz
1299.060	44.3	-1.7	1.0	305.0		0.0	Vert	PK	0.0	42.6	72.8	-30.2	EUT Horiz
1732.000	41.3	0.7	1.3	326.0		0.0	Vert	PK	0.0	42.0	72.8	-30.8	EUT Horiz
1731.855	40.5	0.7	1.0	289.0		0.0	Horz	PK	0.0	41.2	72.8	-31.6	EUT Vert
1299.000	42.3	-1.7	1.4	269.0		0.0	Horz	PK	0.0	40.6	72.8	-32.2	EUT Vert

OCCUPIED BANDWIDTH

XMit 2017.02.08

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Probe - Near Field Set	EMCO	7405	IPI	NCR	NCR
Cable	Fairview Microwave	SCA1814-0101-120	OCZ	NCR	NCR
Block - DC	Fairview Microwave	SD3379	AMV	1/11/2017	1/11/2018
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	11/2/2016	11/2/2017

TEST DESCRIPTION

A near-field probe was placed near the transmitter. A low-loss coaxial cable was used to connect the near-field probe to the spectrum analyzer. The EUT was transmitting at its maximum data rate.

The 20 dB occupied bandwidth is required to be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz.

OCCUPIED BANDWIDTH

XMit 2017.02.08

EUT:	**Vibration Monitoring System**			**Work Order:**	**ELEM0040**
Serial Number:	**16BE04**			**Date:**	**09/06/17**
Customer:	**Sensoteq Ltd**			**Temperature:**	**24.7 °C**
Attendees:	**Idir Boudaoud**			**Humidity:**	**47% RH**
Project:	**None**			**Barometric Pres.:**	**1015 mbar**
Tested by:	**Johnny Candelas**	**Power:**	**Battery**	**Job Site:**	**OC13**

TEST SPECIFICATIONS	**Test Method**
FCC 15.231:2017	ANSI C63.10:2013

COMMENTS

Power Setting -6

DEVIATIONS FROM TEST STANDARD

None

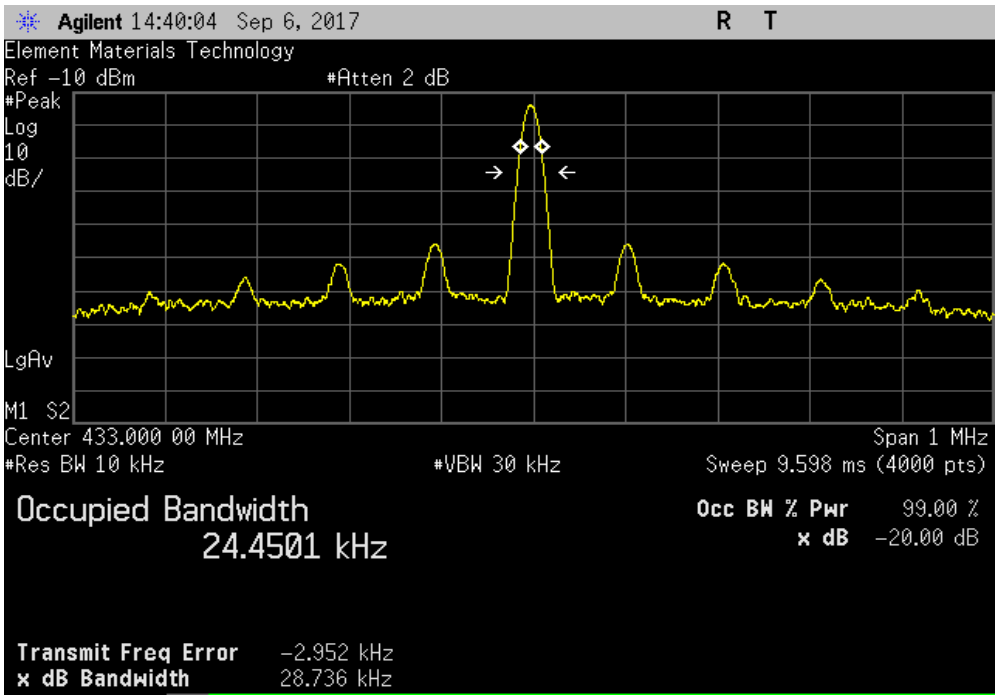
Configuration #	**1**	*Signature*

	Value (kHz)	**Limit (kHz)**	**Result**
Modulated Signal			
433 MHz	28.74	1082.5	Pass

OCCUPIED BANDWIDTH

XMit 2017.02.08

Modulated Signal, 433 MHz						
				Value (kHz)	Limit (kHz)	Result
				28.74	1082.5	Pass



DUTY CYCLE

XMit 2017.02.08

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

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Block - DC	Fairview Microwave	SD3379	AMV	1/11/2017	1/11/2018
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	11/2/2016	11/2/2017

TEST DESCRIPTION

A near-field probe was placed near the transmitter. A low-loss coaxial cable was used to connect the near-field probe to the spectrum analyzer. For software controlled or pre-programmed devices, the manufacturer shall declare the duty cycle class or classes for the equipment under test. For manually operated or event dependant devices, with or without software controlled functions, the manufacturer shall declare whether the device once triggered, follows a pre-programmed cycle, or whether the transmission is constant until the trigger is released or manually reset. The manufacturer shall also give a description of the application for the device and include a typical usage pattern. The typical usage pattern as declared by the manufacturer shall be used to determine the duty cycle and hence the duty class.

Where an acknowledgement is required, the additional transmitter on-time shall be included and declared by the manufacturer.

To derive average emission measurements, a duty cycle correction factor was utilized:

Duty Cycle = On time/100 milliseconds (or the period, whichever is less)

Where “On time” = N1L1 +N2L2 +….

Where N1 is the number of type 1 pulses, L1 is length of type 1 pulses, N2 is the number of type 2 pulses, L2 is the length of type 2 pulses, etc.

Therefore, Duty Cycle = (N1L1 +N2L2 +…)/100mS or T, whichever is less. (Where T is the period of the pulse train.)

The measured values for the EUT’s pulse train are as follows:

Period = 98.43 mSec
Pulsewidth of Type 1 Pulse = 17.73 mSec
Number of Type 1 Pulses = 1

Duty Cycle = 20 log [((1)(17.73))/98.43] = -14.89 dB

The duty cycle correction factor of **-14.89 dB** was added to the peak readings to mathematically derive the average levels. Peak measurements were made with a resolution bandwidth of 100kHz and a video bandwidth of 300kHz.

DUTY CYCLE

XMit 2017.02.08

EUT:	**Vibration Monitoring System**			**Work Order:**	**ELEM0040**
Serial Number:	**16BE04**			**Date:**	**09/06/17**
Customer:	**Sensoteq Ltd**			**Temperature:**	**24.7 °C**
Attendees:	**Idir Boudaoud**			**Humidity:**	**47% RH**
Project:	**None**			**Barometric Pres.:**	**1015 mbar**
Tested by:	**Johnny Candelas**	**Power:**	**Battery**	**Job Site:**	**OC13**

TEST SPECIFICATIONS	**Test Method**
FCC 15.231:2017	ANSI C63.10:2013

COMMENTS

Power Setting -6

DEVIATIONS FROM TEST STANDARD

None

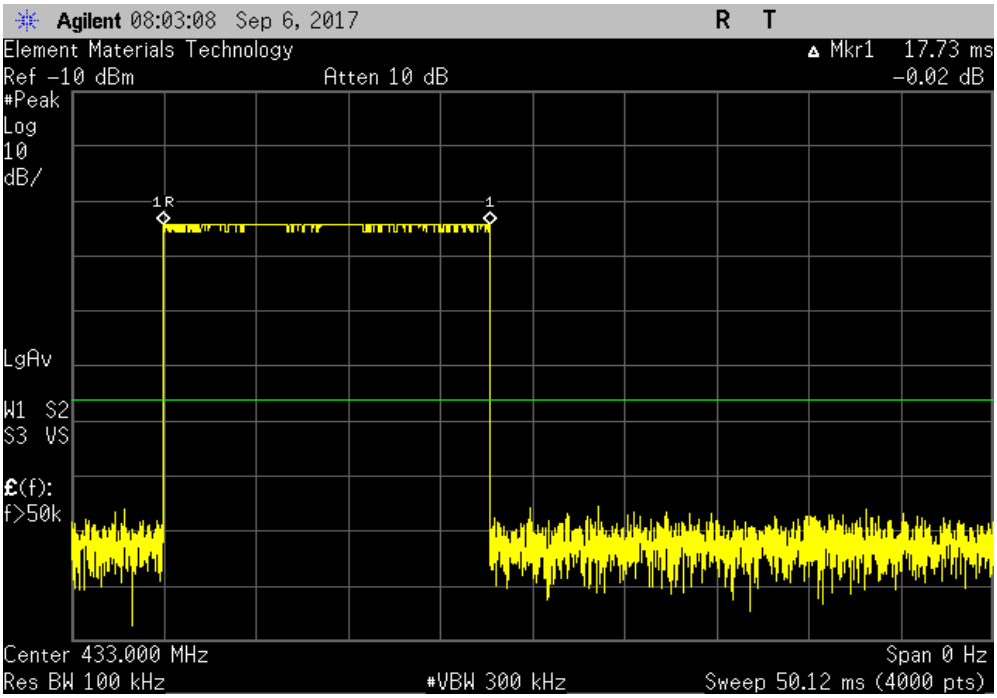
Configuration #	**1**	*Signature*

	Pulse Width (ms)	**Period (ms)**	**Limit**	**Result**
Normal Operation				
50 ms Window - Pulse Width	17.73	N/A	N/A	N/A
100 ms Window - Pulse Width	17.73	N/A	N/A	N/A
500 ms Window - Period	N/A	98.43	N/A	N/A
10 s Window	N/A	N/A	N/A	N/A

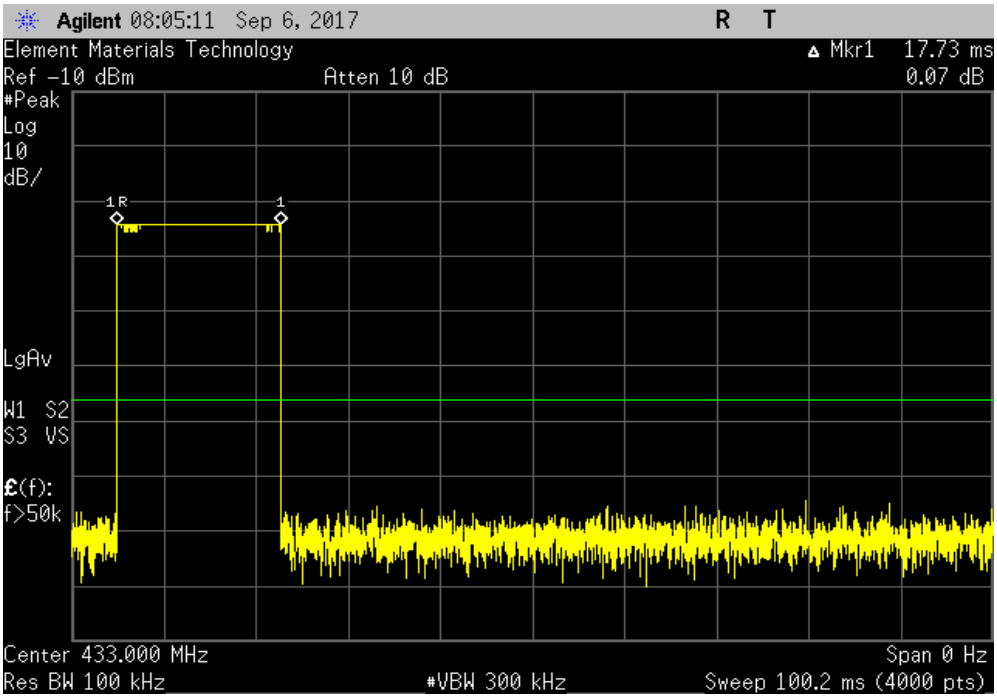
DUTY CYCLE

XMit 2017.02.08

Normal Operation, 50 ms Window - Pulse Width						
			Pulse Width (ms)	Period (ms)	Limit	Result
			17.73	N/A	N/A	N/A



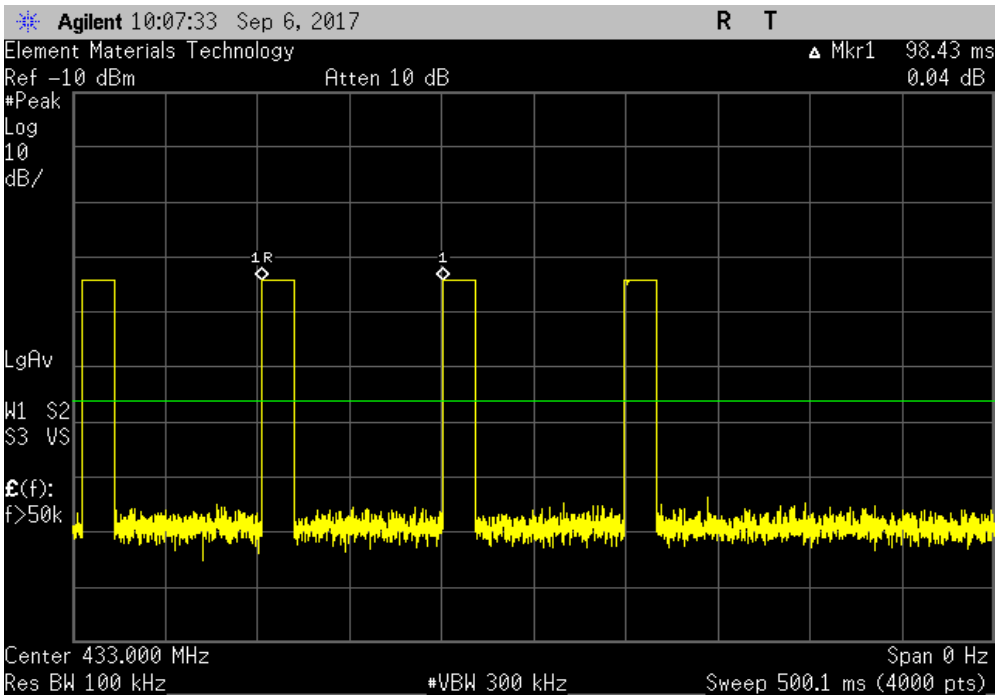
Normal Operation, 100 ms Window - Pulse Width						
			Pulse Width (ms)	Period (ms)	Limit	Result
			17.73	N/A	N/A	N/A



DUTY CYCLE

XMit 2017.02.08

Normal Operation, 500 ms Window - Period						
			Pulse Width (ms)	Period (ms)	Limit	Result
			N/A	98.43	N/A	N/A



Normal Operation, 10 s Window						
			Pulse Width (ms)	Period (ms)	Limit	Result
			N/A	N/A	N/A	N/A